

## IN THE CLAIMS:

1           1.     A method for maintaining cache coherency in a system having a  
2 first controller and a second controller, comprising:  
3           selecting a mirror cache line in a second controller to copy data into;  
4           mirroring the data from a cache line in a first controller to the mirror cache  
5 line in the second controller; and  
6           sending a message from the first controller to the second controller  
7 informing the second controller of cache meta data associated with the mirror  
8 cache line.

1           2.     The method of claim 1, wherein the first controller has information  
2 about the content of the second controller's cache, and the second controller has  
3 information about the content of the first controller's cache.

1           3.     The method of claim 1, wherein the cache meta data includes a  
2 logical unit, a logical block, a dirty bit map, and a cache identifier for the data  
3 associated with the mirror cache line.

1           4.     The method of claim 1 further comprising placing the address of  
2 the mirror cache line into the first controller's hash table.

1           5.     The method of claim 1 further comprising placing the address of  
2 the mirror cache line into the first controller's write back queue.

1           6.     The method of claim 1 further comprising managing a free list of  
2 mirror locations in the second controller's cache by the first controller, and  
3 managing a free list of mirror locations in the first controller's cache by the  
4 second controller, wherein the first and second controllers can copy data into the  
5 second and first controller's mirror locations, respectively.

1           7.     The method of claim 1, further comprising sending a message from  
2 the first controller to the second controller, requesting ownership of a cache line  
3 owned by the second controller.

1           8.     The method of claim 7, further comprising granting ownership of a  
2 cache line owned by the second controller, to the first controller, wherein,  
3 subsequent to the first controller receiving data that is to be mirrored to the  
4 second controller cache line, transferring data to the second controller's cache  
5 line from the first controller.

1           9.     The method of claim 8, further comprising sending a message from  
2 the first controller to the second controller providing the second controller of  
3 cache meta data associated with the mirror cache line.

1           10.    The method of claim 1, further comprising switching ownership of  
2 cache lines between the first controller and the second controller.

1           11.    The method of claim 1, further comprising, during failback,  
2   transferring cache lines from a survivor controller that owns a substantial number  
3   of mirror cache lines, to a replacement controller unit.

1           12.    The method of claim 1, further comprising, sending a message to a  
2   controller of a mirror cache line, informing the controller that the associated  
3   cache line will be flushed and the data associated with the mirror cache line will  
4   be temporarily invalid.

1           13.    The method of claim 12, wherein sending the message to the  
2   controller of the mirror cache line further comprises, informing the controller that  
3   after the associated cache line is destaged, and the mirror cache line's data is  
4   consistent with a backing disk and need not be written to the backing disk in the  
5   event of a failover.

1           14.    The method of claim 1, further comprising, indicating to the first and  
2   second controller that a cache line that has been flushed of data, is available for  
3   reuse.

1           15.    A controller system for maintaining cache coherency, comprising:  
2           a disk array,  
3           a first controller, coupled to the disk array, for selecting a mirror cache line  
4   on a second controller; and  
5           an interface for mirroring the data from a first controller cache line to the  
6   second controller cache line;  
7           wherein a message is sent from the first controller to the second controller  
8   informing the second controller about cache meta data associated with the mirror  
9   cache line.

1           16.    The controller system of claim 15 wherein the first controller has  
2   information about the content of the second controller's cache, and the second  
3   controller has information about the content of the first controller's cache.

1           17.    The controller system of claim 15, wherein the cache meta data  
2   includes a logical unit, a logical block, a dirty bit map, and a cache identifier  
3   associated with the mirror cache line.

1           18.    The controller system of claim 15 further comprising the first  
2   controller placing the address of the mirror cache line into the first controller's  
3   hash table.

1           19.    The controller system of claim 15 further comprising the first  
2   controller placing the address of the mirror cache line into the first controller's  
3   write back queue.

1           20.    The controller system of claim 15 further comprising the first  
2   controller managing a free list of mirror locations in the second controller's  
3   cache, and the second controller managing a free list of mirror locations in the  
4   first controller's cache, wherein the first and the second controller can copy data  
5   into the second and the first controller mirror locations, respectively.

1           21.    The controller system of claim 15, further comprising the first  
2   controller sending a message to the second controller, requesting ownership of a  
3   cache line owned by the second controller.

1           22.    The controller system of claim 21, wherein the second controller  
2   sends a message granting ownership of a cache line owned by the second  
3   controller, to the first controller, wherein, subsequent to the first controller  
4   receiving data that is to be mirrored to the second controller cache line,  
5   transferring that data to the second controller's cache line from the first  
6   controller.

1           23.    The controller system of claim 22, further comprising the first  
2   controller sending a message from to the second controller informing the second  
3   controller of cache meta data associated with the mirror cache line.

1           24.    The controller system of claim 15, wherein the first and second  
2   controllers switch ownership of cache lines.

1           25.    The controller system of claim 15, further comprising, during  
2   failback, a survivor controller that owns a substantial number of mirror cache  
3   lines transfers associated cache lines to a replacement controller unit.

1           26.    The controller system of claim 15, wherein a message is sent to a  
2   controller of a mirror cache line, informing the controller that the associated  
3   cache line will be flushed and the data associated with the mirror cache line will  
4   be temporarily invalid.

1           27.    The controller system of claim 26, wherein the message that is sent  
2   to the controller of the mirror cache line further comprises, informing the  
3   controller that after the associated cache line is destaged, the mirror cache line's  
4   data is consistent with a backing disk and need not be written to the backing disk  
5   in the event of a failover.

1           28.    The controller system of claim 15, further comprising, indicating to  
2   the first and second controller that a cache line that has been flushed of data is  
3   available for reuse.

1           29.    An article of manufacture comprising a program storage medium  
2   readable by a computer, the medium tangibly embodying one or more programs  
3   of instructions executable by the computer to perform a method for maintaining  
4   cache coherency, the method comprising:

5           selecting a mirror cache line in a second controller to copy data into;  
6           mirroring the data from a cache line in a first controller to the mirror cache  
7   line in the second controller; and

8           sending a message from the first controller to the second controller  
9   informing the second controller of cache meta data associated with the mirror  
10   cache line.

1           30.    A storage system for maintaining cache coherency, comprising:  
2           means for selecting a mirror cache line in a second controller to copy data  
3   into;

4           means for mirroring the data from a cache line in a first controller to the  
5   mirror cache line in the second controller; and

6           means for sending a message from the first controller to the second  
7   controller informing the second controller of cache meta data associated with the  
8   mirror cache line.